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Beryllium Related Matter

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Beryllium Program Interim Controls, Compensatory Measures and Initiatives As of December 23, 2008

Introduction

In recent months, LLNL has identified, commenced, and implemented a series of interim controls, compensatory measures, and initiatives to ensure worker safety, and improve safety processes with regards to potential worker exposure to beryllium. Many of these actions have been undertaken in response to the NNSA Independent Review (COR-TS-5/15/2008-8550) received by LLNL in November of 2008. Others are the result of recent discoveries, events or incidents, and lessons learned, or were scheduled corrective actions from earlier commitments. Many of these actions are very recent in nature, or are still in progress, and vary in the formality of implementation. Actions are being reviewed for effectiveness as they progress. The documentation of implementation, and review of effectiveness, when appropriate, of these actions will be addressed as part of the formal Corrective Action Plan addressing the Independent Review.

The mitigating actions taken fall into the following categories:

1) Responses to specific events/concerns
2) Development of interim controls
3) Review of ongoing activities
4) Performance improvement measures

1) Response To Specific Events Or Concerns In The Independent Review Report

a) In the NNSA Independent Review, observation BE.4-2, it was stated "LLNS needs to evaluate the IWS for brazing of beryllium parts in Building 231 to ensure that it contains the appropriate level of beryllium hazard controls per 10CFR850.20." In response to this concern, the authorizing

organization for this activity, the Engineering Technologies Division, decided to de-authorize work with beryllium under IWS 12134 (beryllium had not been brazed since 2006 in this operation). This was implemented by revising the scope of work for this IWS, and by removing beryllium as a hazard from the document. Post-decontamination swipes taken in October 2006, after the last time beryllium work was performed, indicate that the vacuum chucks and other associated equipment showed no beryllium above the release limit.

b) Observation BE.4-1 from the same report states, "LLNS needs to conduct an activity-specific hazard analysis for the beryllium study being conducted in Building 695." In response to this concern, the Team 1 Industrial Hygienist (IH) reviewed the activities in the Treatment Lab of Building 695 with the Responsible Individual (RI) for the activity, and updated the hazard description and controls in IWS 2563, which authorizes this activity. The following language was added to the hazard description section:

"Beryllium Decontamination Investigation: Various sample surfaces, such as steel and photo trays, will be spiked with soluble or insoluble beryllium compounds. These surfaces will be cleaned with different cleaning agents to determine which is most effective. Swipes will be taken to determine effectiveness of the cleaning method."

The following language was added to the controls section:

"Beryllium Decontamination Investigation: All work will be conducted in a laboratory fume hood, which will be posted as a beryllium work area. This posting will remain on the hood until it is confirmed that all surfaces are below the beryllium release limit (<0.2ug/100cm2). PPE for this work shall be lab coat, safety glasses and nitrile or latex gloves.

Swipes will be taken to verify that materials are appropriately labeled and that the surrounding work area remains clean."

c) The NIF Directorate authorizes activities in a machine shop, in Building 298. In response to an August 2008 discovery of legacy beryllium and lead surface contamination in a bead blaster in this shop, NIF locked out the three bead blasters in their facilities, and conducted swipe and air sampling to determine the extent of the surface contamination, and whether the operation of the bead blaster could have resulted in potential airborne exposure. The results of the air sampling were below occupational exposure limits (2.0 micrograms per cubic meter, µg /m^3, of air for an 8-hour work shift), indicating that there was no potential for airborne exposure from this operation. In addition, NIF has added controls to the work in this shop, including an approved materials list, a log system to describe all jobs performed, and de-authorizing work on copper stock without a pedigree (to eliminate the chance of unidentified Cu/Be alloy from being machined). These controls reduce the possibility of worker exposure caused by either intentional or unintentional handling of hazardous materials, including beryllium.

2) Development of Interim Controls

During November and December, a series of meetings were held to discuss LLNL's current beryllium work activities, and potential for beryllium exposure in legacy-contaminated facilities. These meetings included senior managers with experience in work control and facility management, ES&H Team Leaders, Industrial Hygiene (IH) staff, and facilities staff. As a result of these meetings and response to the Beryllium Safety Pause, LLNL identified additional interim controls that we are in the process of applying to work with the highest risk of potential exposure to beryllium:

a) The Facilities and Infrastructure Directorate (F&I) has implemented an additional work release process for facilities work in all LLNL facilities. The new process applies graded review and controls based on both the work activity, and the facility characterization. Each facility is designated a

color (Green, Yellow or Orange) based on the baseline sampling survey as described on the CBDPP web page, https://be-prevention-int.llnl.gov/rooms.php. The combination of activities and work areas recognized to be beryllium-safe, such as: exterior activities, custodial work in Green buildings and in non-laboratory areas of other buildings, as well as non-disruptive activities such as surveillances, are exempt from the beryllium work review process. Work orders in Green buildings where work is to be performed above floor and below eight feet, and not breaking into air streams of HVAC systems receive the lower level of review. Work below floors (e.g. computer floors), above eight feet, or work that requires breaking into the air streams of HVAC systems of Green buildings, and any work in Yellow or Orange buildings, or buildings not yet fully characterized receive a higher level of review. This review is documented in a beryllium work review form developed by the F&I Directorate and designed to incorporate the expertise and knowledge from both industrial hygienists and facility management personnel. The new beryllium work review process is being incorporated into the current work control process. The steps outlined above provide a graded path forward which focuses beryllium work review efforts on those activities which may need further controls while allowing work to continue where the assessed risk is very minimal.

b) Since April 2008, LLNL has implemented more stringent controls for work involving potential exposure to beryllium in the National Ignition Facility and Photon Sciences Principal Directorate (NIF&PS). All work in this Directorate that has any potential for worker exposure to beryllium, including work in HVAC or local exhaust ducts, or working above a suspended ceiling or at heights greater than eight feet above the floor is submitted with the highest level of work permit (Permit Authorization Level PAL 4), requiring approval by the NIF&PS Deputy PAD for Operations. After the DPAD reviews the permit, the PAL level could be downgraded.

This ensures management visibility for work with potential exposure to beryllium.

c) In order to ensure all work performed by subcontractors is reviewed specifically for beryllium hazards, ES&H Team 1 and 2 Team leaders or deputies have begun to forward all Procured Work Services (PWS) worksheets for work in any Yellow and Orange facilities, and all work in any facility with beryllium hazard identified, to the Team IH for specific beryllium review. PWSs are the authorization document allowing subcontractors to perform limited scope work in LLNL facilities, typically performing setup or service contract type work on Laboratory equipment.

d) Several interim controls have been implemented in the Weapons and Complex Integration Directorate's Radioactive and Hazardous Waste Management Division (RHWM), which manages operations in B695 as well as waste collection across the entire LLNL sites. RHWM has implemented a beryllium work area and storage area list and waste disposal requisition protocol, which allows increased confidence in identifying waste generated in areas where beryllium contamination is a concern. This process is similar to the Radioactive Materials Management Area principle that RHWM has used for years to identify waste with the potential for added radioactivity. The Waste Disposal Requisition (WDR), which is the document used to gather and document information about wastes to ensure proper handling and disposal, was updated to add check boxes specifically for the presence and absence of beryllium. This protocol assists RHWM in the performance of hazard identification, and provides consistent information about the extent and form of beryllium that can be found in the waste to be handled and managed in RHWM facilities.

e) A process is being developed to require respiratory protection for all breaks into HVAC or process ventilation systems in Yellow and Orange facilities, unless the immediate duct section or sections have been swipe-

sampled within the past 3 years (sample results are acceptable and process knowledge indicates no potential for contamination since the last sampling was completed), and an IH must clear the work area.

f) A process is being established with the F&I Directorate and other affected directorates to restrict dust-producing activities (including vacuuming and tearing out carpeted flooring greater than four square feet) on un-sampled carpeted floors in all Orange facilities.

3) *Review of Ongoing Activities*

a) On November 7, 2008, Deputy Director Steve Liedle directed each Principal Associate Director (PAD) to ensure the review of all beryllium related IWSs, PWSs, and work permits for proper identification of hazards, and description and implementation of controls. Beryllium work under these documents was paused by Authorizing Individuals (AIs), and the review was completed by AIs and RIs together, with the assistance of the ES&H Team IH. The scope of the review required AIs to:

- Conduct an IWS review
- Review control requirements with affected employees
- Ensure employees completed required beryllium safety training
- Ensure the work is performed within the authorized scope and using the specified controls
- Ensure that labeling and posting are performed in accordance with the ES&H Manual
- Ensure that beryllium items are included in any required inventory systems

Additional reviews were required for service provider organizations performing facility work.

The summary of the status, as of December 22, 2008 of the pause, and any lessons learned as a result, is presented below:

I. **Global Security.** This review was completed and documented on November 21, 2008. Eleven IWSs were identified with potential for worker exposure to beryllium. No unprotected work was identified. Nine of the IWS reviews resulted in minor wording changes to clarify the hazards description, work controls, training requirements or surveillance. These changes were corrected immediately. The results of this review are detailed in ITS #26849. For two of the identified IWSs, the proposed beryllium work was never conducted. For these activities, reference to beryllium in the scope of work, and the hazard description and controls were removed from the documents.

II. **Weapons and Complex Integration.** The review is completed for 23 of 27 of the IWSs that were identified within Radiation and Hazardous Waste Management (RHWM). No unprotected work was identified. Language was clarified in several IWSs.

    All work permits and Operational Safety Plans (OSPs) currently authorized for operation in Superblock were reviewed, and the wording and controls in two OSPs were fortified.

    The review for Primary Nuclear Design (HEAF, S-300, Nevada) is completed for the two identified IWSs with beryllium work. Other IWSs were reviewed to ensure no unprotected work existed. Appropriate controls for the presence of BeCu in electronic equipment are in development through the ES&H Team and beryllium SME. Additional controls have been added to IWSs for activities at BEEF (Nevada), and CFF at Site 300.

In Nuclear Weapons Engineering (S-300), two IWSs address beryllium hazards and both remain paused. One IWS will be revised to ensure consistency in hazard and control description. The other IWS is in the major change process, and has not been restarted yet. The Building 191 Facility Safety Plan (FSP) was also reviewed to ensure beryllium hazards are identified. Hazards and controls for the use of beryllium camera rotors are covered in the Building191 FSP and will be duplicated and/or referenced in applicable IWSs.

III. **NIF.** All 26 IWSs and OSP 581.1 have been reviewed and beryllium work has been restarted. The majority of the IWS reviews resulted in minor wording changes to clarify the hazards description, work controls, training requirements or surveillance. The IWS changes were corrected immediately. Approximately 50 actions are being entered into ITS.

IV. **Science and Technology (S&T).** This review is still in process. Issues uncovered to date have been entered as ITS # 26991 and are being reviewed for Institution applicability and will be finalized and tracked as appropriate.

The Engineering Directorate has reviewed 42 IWSs and 17 remain paused. Work has resumed on activities authorized in 15 IWSs, while five IWSs were archived and beryllium work was deleted from five others. Activities authorized by six IWSs were paused strictly for Cu-Be issues.

Physical and Life Sciences Directorate has 23 IWSs remaining to be reviewed. These remaining paused activities are primarily work involving small beryllium articles (e.g. target windows). This review identified 16 issues.

V. **Operations and Business (O&B).** All affected directorates in O&B have completed their reviews. Facilities & Infrastructure (F&I) has added several improvements to their work control system including a beryllium work review form which asks questions about the location of the work, requires industrial hygienist data reviews and signature, and also requires a facility manager's approval. For example, work in Orange facilities requires the concurrence of the Facilities Management Department (FMD) manager or the deputy manager. Work in Yellow facilities requires the concurrence of the Area Facilities Operations Manager (AFOM). Final agreement has been reached with Super Block on 12/15/2008 to use Super Block's current work control process to ensure a beryllium-safe environment for F&I workers to perform their work. Final agreement has also been reached with Site 300 to use supervisory personnel at Site 300 to review and complete F&I's beryllium work review process. Final agreements are nearing completion with other program facilities (NIF, HEAF, TSF, and RHWM) to determine if the form is an enhancement or duplication of steps already in their work control system.

   The Environmental Restoration Department (ERD) Decommissioning and Demolition (D&D) group is the only organization in the O&B PAD that can perform beryllium work. They have reviewed their IWSs and standard operating procedures. The ERD Department Head and the O&B Principal Associate Director discussed in detail the standard operating procedures and the IWS controls used for beryllium decontamination. On 12/03/08 the O&B Principal Associate Director, Frank Russo, gave permission to the D&D group to resume beryllium decontamination work.

VI. **Security.** All Security Organization (SO) IWSs were reviewed by their respective responsible individuals/authorizing individuals and safety staff for beryllium hazards/control applicability. Four of the

IWSs for "service providers" needed beryllium updates. No work is being done where beryllium exposure is possible with respect to these IWSs, until the updated IWSs are authorized. All actions will be entered into ITS # 26849.

VII. **Environmental Protection Department.** This review is complete. Two IWSs were found to need updates in the identification and wording of beryllium hazards and controls.

VIII. **Hazards Control Department.** This review is complete. No unprotected work was identified, but minor changes to training and labeling were found and addressed, and wording was clarified.

When all reviews are complete and documented an independent assessment of the effectiveness of the beryllium work pause will be conducted at the direction of the Deputy Director. 10-15 representative IWS authorized activities from across the Lab will be reviewed for evidence of the recent review. For each IWS, the RI and AI will be interviewed and the documentation of the pause reviewed including records in the ITS system. A written report of this assessment will be provided to the Deputy Director and shared as lessons learned.

b) During October of 2008, the Hazards Control Department of LLNL completed an assessment of work controls and practices in the ten facilities identified as having the greatest amount of ongoing beryllium work. The assessment included a review of actual work tasks by responsible individuals, facility management, and ES&H Team industrial hygienists, a review of implemented controls, including engineering, administrative, and PPE controls, and the current status of legacy equipment. The report was reviewed by the beryllium SME in December and the one finding, seven suggestions, and three note-worthy practices will be tracked to closure in ITS #27022.

c) On November 4, 2008, Hazards Control Department Head Richard Nugent called a mandatory meeting of industrial hygienists, including the Team IHs as well as the SMEs, and Section and Team management to specifically discuss criteria for beryllium sampling, and response to emergent events. Out of this meeting, the Team IHs identified a list of specific questions that needed clarification by the beryllium SME to ensure consistent implementation. A process was developed to gather these on an ongoing basis, and track answers from the SME, in order to ensure consistency in implementation of beryllium controls.

4) *Performance Improvement Measures*

a) A formal plan for internal communications involving beryllium issues has been developed and is in the process of being executed. In particular, the plan identifies the audiences to whom communications are to be delivered, the content and format of those communications, and the point of contact for each effort. The plan is designed to be updated as conditions change, and will be used to capture all formal communication efforts. Currently identified audiences include the following:

- General LLNL employees and contractors
- Residents of all Be legacy facilities
- Residents of affected/Orange facilities
- Supervisors and employees of service providers of beryllium facilities
- Associated beryllium workers and their supervisors
- Employees who may have been unknowingly exposed
- Sensitized employees and their supervisors

b) On December 2, 2008, Deputy Director Steve Liedle announced the appointment of a Beryllium Project Manager, reporting directly to the Deputy Director's office. The function of this position is to coordinate the

many current LLNL efforts in response to beryllium issues, and to provide the highest level of management visibility. The responsibilities of this position include the following:

- Coordinate efforts of Hazards Control, Health Services, Public Affairs, Causal Analysis/IA/CAP/Employee Safety teams, and LLNL programs with regards to beryllium issues
- Ensure the development, negotiation, documentation, tracking, and closure of a comprehensive Corrective Action Plan in response to the NNSA Independent Review
- Coordinate and ensure the completion of internal communications to programs, facilities, and general employees on the status of beryllium hazard identification, characterization, controls, and exposure metrics
- Maintain an effective relationship with LSO and other oversight organizations

c) On December 12, 2008, Hazards Control Department Head Richard Nugent announced the appointment of Steven Lee, CIH, as Beryllium Program Subject Matter Expert (SME). This role will assume leadership in the development and implementation of improvements and revisions to LLNL's CBDPP. The selection increases the resources that are available to concentrate on improvement to and maintenance of beryllium safety programs. The outgoing beryllium SME, George Fulton, CIH, will continue to gather historical documents and other records in support of the facility characterization and baselining efforts.

d) As part of the beryllium work review announced on November 7, 2008, Deputy Director Liedle commissioned an employee safety team to review institutional work practices and guidelines, particularly those documented in the ES&H Manual. The group has representatives from directorates performing work with beryllium, as well as ES&H and Facilities and Infrastructure. Recent efforts have included a gap analysis of Document

14.4, identification of inconsistent work practices across LLNL, and a recommendation of a document structure that is more user-friendly, and conducive to consistent application of controls to work of similar probability of exposure. A preliminary report from the group, including suggested actions, was received by the Deputy Director on December 19, 2008.

Summary

A wide variety of efforts have been identified and initiated in response to the concerns with worker beryllium exposure. These efforts are being implemented on a “real-time” basis, and are being reviewed for effectiveness on an ongoing basis to ensure that worker safety is being protected. In addition, we are focused on an institution-wide system approach which will be folded into our formal corrective action plan.